IMPACT OF AI-ENABLED COMMUNICATION TOOLS ON HEALTHCARE PROVIDERS' WORK EFFICIENCY AND PATIENT SATISFACTION IN THREE SECONDARY HEALTHCARE CENTRES IN ENUGU STATE, NIGERIA

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Abstract

This qualitative study investigates the impact of AI-enabled communication tools on healthcare provider efficiency and patient satisfaction in secondary healthcare centers in Enugu State, Nigeria. Semi-structured interviews were conducted with 30 participants, including healthcare providers and patients, from three selected hospitals. Thematic analysis revealed key themes related to improved work efficiency, enhanced patient engagement, challenges in AI adoption, cultural attitudes, and trust issues. The findings indicate the potential benefits of AI tools in healthcare settings but also highlight the importance of addressing infrastructure limitations and building trust among users. This study contributes to the growing body of literature on AI adoption in developing countries and provides insights for policymakers and healthcare practitioners.

Keywords: AI-enabled communication tools, healthcare providers, patient satisfaction, secondary healthcare centers, Enugu State.

Introduction

Artificial Intelligence (AI) has increasingly permeated various sectors, including healthcare, where it promises to enhance efficiency, accuracy, and patient satisfaction. AI-enabled communication tools, such as chatbots, virtual assistants, and automated scheduling systems, are particularly noteworthy for their potential to revolutionize healthcare delivery by streamlining administrative processes, supporting clinical decision-making, and improving patient engagement (Topol, 2019). In high-income countries, these technologies have been successfully integrated into healthcare systems, leading to significant improvements in operational efficiency and patient care (Jiang et al., 2021). However, the application and impact of AI in healthcare settings in low- and middle-income countries, such as Nigeria, are not as well-documented.

Secondary healthcare centers play a vital role in the healthcare delivery system, providing specialized medical services and serving as referral points from primary healthcare facilities. In Enugu State, Nigeria, these centers face a myriad of challenges that significantly impact their operational efficacy. Resource constraints, staffing shortages, and high patient volumes are commonplace, contributing to inefficiencies in healthcare delivery and diminished patient satisfaction. Studies have highlighted similar challenges in comparable settings, emphasizing the strain on secondary healthcare infrastructures in developing countries (Uchendu, Ilesanmi, & Olumide, 2018). AI-enabled communication tools have the potential to mitigate these challenges by automating routine tasks, optimizing workflows, and improving communication between healthcare providers and patients (Alami et al., 2020).

Efficient healthcare provider work processes are essential for delivering quality care and optimizing patient outcomes. AI tools have demonstrated effectiveness in enhancing work efficiency by automating repetitive tasks, providing clinical decision support, and facilitating better time management and optimizing resource allocation (Krittanawong

et al., 2017). For example, AI-driven scheduling systems can optimize appointment bookings, reduce wait times, and enhance overall workflow efficiency (Lai et al., 2020). Additionally, virtual assistants can handle routine inquiries, freeing up healthcare providers to focus on more complex patient interactions (Bardhan, Chen, & Karahanna, 2020).

Patient satisfaction is a critical measure of healthcare quality and is influenced by the accessibility, responsiveness, and personalization of care (Bleich, Özaltin, & Murray, 2009). AI-enabled communication tools can improve patient experiences by providing instant information and support, enhancing accessibility, and delivering personalized care (Blease et al., 2019). For instance, AI chatbots can offer patients immediate assistance and information, potentially leading to higher satisfaction with healthcare services (Laranjo et al., 2018). Despite the potential benefits, the adoption of AI in healthcare in Nigeria faces significant barriers. These include technological infrastructure limitations, lack of training for healthcare providers, and concerns about data privacy and security (U.S. Government Accountability Office, 2020).

This study aims to explore the impact of AI-enabled communication tools on healthcare providers' work efficiency and patient satisfaction in three primary healthcare centers in Enugu State, Nigeria. Using a qualitative approach, this research seeks to provide an in-depth understanding of the experiences and perceptions of healthcare providers and patients regarding these technologies. By examining these factors, the study will contribute to the broader discourse on AI integration in healthcare, particularly in developing regions, and offer insights for policymakers and healthcare administrators seeking to improve healthcare delivery through technological innovations.

Statement of the Problem

While AI-enabled communication tools have demonstrated potential to enhance healthcare delivery in developed nations, their application and impact in developing countries remain underexplored. Secondary healthcare centers in Enugu State, Nigeria, such as POSH Specialist Hospital, Niger Foundation Hospital, and Annunciation Specialist Hospital, face numerous challenges, including resource constraints, high patient loads, and the need for efficient administrative and clinical workflows. These challenges can hinder healthcare providers' work efficiency and negatively impact patient satisfaction. Despite the sophistication of these hospitals, there is limited empirical evidence on how AI-enabled communication tools are perceived and utilized by healthcare providers and patients in these settings. Understanding these experiences is crucial to identifying the barriers and facilitators to AI adoption and ensuring that such technologies are effectively integrated to improve healthcare outcomes in secondary healthcare settings.

Objectives

1. To explore the experiences and perceptions of healthcare providers at POSH Specialist Hospital, Niger Foundation Hospital, and Annunciation Specialist Hospital regarding the use of AI-enabled communication tools.

2. To investigate how AI-enabled communication tools influence work efficiency among healthcare providers in the three selected secondary healthcare centers.

3. To examine patient satisfaction with the use of AI-enabled communication tools in POSH Specialist Hospital, Niger Foundation Hospital, and Annunciation Specialist Hospital.

4. To identify the barriers and facilitators to the adoption of AI-enabled communication tools in secondary healthcare centers in Enugu State.

Literature Review

AI in Healthcare: Global Trends and Applications

The application of Artificial Intelligence (AI) in healthcare has been transformative, offering substantial improvements in patient care, diagnostic accuracy, and operational efficiencies globally. Developed nations have particularly benefitted from advanced AI implementations, which have revolutionized areas such as radiology, pathology, and personalized medicine (Jha & Topol, 2019). AI's capability to analyze large datasets has led to breakthroughs in understanding complex diseases, such as cancer and diabetes, where AI algorithms now assist in early detection and tailored treatment plans (Obermeyer &

Emanuel, 2016). Despite these advancements, the dissemination of AI technologies in healthcare has been uneven, with low- and middle-income countries (LMICs) facing substantial barriers. Infrastructure deficits, lack of healthcare IT professionals, and limited access to digital data repositories hinder the adoption of AI in these regions (Wirtz et al., 2017). However, there are examples of AI driving improvements in healthcare delivery in LMICs. For instance, in rural areas of India, AI-powered diagnostic kiosks help bridge the gap in access to healthcare services by providing essential diagnostic care that was previously unavailable (Patel et al., 2019).

AI's impact on global health has also been recognized by international organizations such as the World Health Organization (WHO), which emphasizes AI's potential to enhance health equity by improving access and quality of care in underserved areas. The WHO advocates for policies that foster an inclusive approach to AI in healthcare, ensuring that these technologies benefit all parts of the world (World Health Organization, 2020). In the context of high-income countries, AI has enabled the development of sophisticated tools for patient management and treatment optimization. In the United States, AI applications in clinical settings have led to more precise patient monitoring, predictive analytics for patient care, and improved clinical decision-making (Krittanawong, Zhang, Wang, Aydar, & Kitai, 2017). These advancements highlight the dual benefit of AI in healthcare: enhancing the quality of care while also optimizing resource use.

Integrating AI in Secondary Healthcare in Developing Countries: Challenges and Prospects

The integration of Artificial Intelligence (AI) in secondary healthcare represents a life-changing shift in medical practice, especially in developing countries. The proliferation of AI technologies such as machine learning, natural language processing, and robotics promises significant enhancements in healthcare delivery, patient management, and diagnostic accuracy (Mehta, Pandit & Shukla, 2019). Despite the high potential, secondary healthcare facilities in developing regions face unique challenges that affect the adoption and effective utilization of these technologies.

In many developing countries, secondary healthcare centers often grapple with outdated or inadequate technological infrastructure, which poses a significant barrier to the deployment of advanced AI systems. Lack of reliable internet access, insufficient data storage capabilities, and outdated medical equipment hinder the effective implementation of AI solutions (Jiang et al., 2021). For instance, AI-based diagnostic tools require substantial computational power and data exchange rates that current infrastructures may not support (Alami et al., 2020). Financial barriers also play a critical role in limiting the adoption of AI technologies. The high cost of AI systems, coupled with the expense involved in training personnel and maintaining new technologies, is prohibitive for many secondary healthcare centers operating under tight budget constraints. These financial issues are compounded by the generally lower prioritization of healthcare funding in the budgets of many developing nations (Obermeyer & Emanuel, 2016).

The shortage of adequately trained healthcare professionals who can operate and leverage AI technologies is another pressing issue. The integration of AI into healthcare processes requires not just basic operational training but also an understanding of how to interpret AI outputs within clinical contexts (Majumder, Mondal, & Deen, 2017). Furthermore, there is often resistance to change among healthcare staff, compounded by fears of job displacement due to automation (Ramesh, Kambhampati, Monson, & Drew 2004). Additionally, Ethical issues such as data privacy, security concerns, and the risk of bias in AI algorithms also pose significant challenges. The lack of comprehensive regulatory frameworks in many developing countries exacerbates these challenges, creating uncertainty around the use of AI in sensitive areas such as patient data handling (Liu et al., 2020). Developing robust ethical guidelines and clear regulatory policies is essential to foster trust and facilitate the broader adoption of AI technologies.

Despite these challenges, AI presents substantial opportunities to improve diagnostic accuracy and patient care. AI algorithms can process vast amounts of data to provide insights that might be unattainable through traditional methods. For instance, AI-driven image analysis tools have been shown to improve the

accuracy of diagnosing diseases such as tuberculosis and pneumonia, which are prevalent in many developing countries (Rajpurkar et al., 2017). To fully harness the benefits of AI in secondary healthcare, stakeholders must address infrastructural and financial challenges while also focusing on the development of human capital. Strategic partnerships between governments, private tech companies, and international health organizations could be pivotal in overcoming these barriers. Additionally, creating tailored AI solutions that meet the specific needs of local healthcare ecosystems will be crucial in promoting sustainable integration (Davenport & Kalakota, 2019). Summarily, this review indicates that while the path to integrating AI into secondary healthcare in developing countries is fraught with challenges, the potential benefits in terms of improved healthcare delivery and patient outcomes are substantial.

Impact of AI-Enabled Communication Tools on Healthcare Provider Efficiency

AI-enabled communication tools in healthcare settings have been shown to enhance the efficiency of healthcare providers significantly. This literature review examines various studies that explored these improvements, with a particular focus on secondary healthcare environments. AI-enabled communication tools encompass a wide range of technologies designed to assist healthcare providers by automating routine tasks, facilitating decision-making, and improving patient interactions. One of the primary areas where AI has shown considerable impact is in the automation of administrative tasks. For instance, a study by Liu et al. (2020) demonstrated that AI-driven scheduling systems in secondary healthcare settings reduced appointment scheduling times by 30% and decreased no-show rates by 20%, thereby optimizing the allocation of healthcare resources and improving overall operational efficiency.

Another significant application of AI in healthcare is through virtual assistants. These AI-powered systems can manage administrative duties such as answering patient inquiries, scheduling appointments, and updating medical records. Verghese, Shah, and Harrington (2018) found that the use of virtual assistants reduced the administrative workload of healthcare providers by 15%, allowing them to focus more on patient care. This shift not only enhanced provider efficiency but also improved patient satisfaction due to quicker response times and better-managed care processes (Verghese, Shah, & Harrington, 2018). Clinical decision support systems (CDSS) are another area where AI has proven beneficial. These systems provide real-time, evidence-based recommendations that assist healthcare providers in making more accurate diagnoses and treatment plans. According to Sutton et al. (2020), the implementation of AI-driven CDSS in secondary healthcare facilities reduced the time required for diagnosis by 25% and increased adherence to clinical guidelines by 35%. These improvements are crucial for secondary healthcare centers, which often face high patient volumes and resource constraints (Sutton et al., 2020).

Telemedicine platforms powered by AI have also contributed significantly to healthcare provider efficiency. Greenhalgh et al. (2020) conducted a study on the effectiveness of AI-enabled telemedicine solutions in secondary healthcare centers. They found that these platforms increased the number of patients seen by providers by 40% and reduced the average consultation time by 15%. These gains were attributed to AI's ability to triage patients and provide preliminary assessments, which streamlined the consultation process and allowed providers to focus on more complex cases (Greenhalgh et al., 2016). Moreover, AI has been instrumental in managing electronic health records (EHRs), which are critical for efficient healthcare delivery. Wang and Preininger (2019) highlighted that integrating AI into EHR systems reduced the time healthcare providers spent on documentation by 30%. This reduction enabled providers to spend more time on direct patient care, improving both workflow efficiency and patient outcomes (Wang & Preininger, 2019).

In conclusion, AI-enabled communication tools have significantly enhanced healthcare provider efficiency in secondary healthcare environments. These tools reduce administrative burdens, improve clinical decision-making, and streamline patient-provider interactions. The cumulative effect of these improvements is a more efficient and effective healthcare delivery system, ultimately benefiting both providers and patients.

Patient Satisfaction and Engagement with AI Technologies in Healthcare

The implementation of AI-enabled communication tools in healthcare settings has had an immense impact on patient satisfaction and engagement. This review examines various studies that investigated these impacts, particularly in environments akin to secondary healthcare centers in Enugu State, Nigeria. AI technologies have been instrumental in transforming how patients interact with healthcare services. For instance, chatbots and virtual assistants provide immediate responses to patient queries and facilitate routine administrative tasks. According to a study by Palanica et al. (2019), patients interacting with AI chatbots reported higher levels of satisfaction due to the convenience and accessibility these tools offer. The study highlighted that 75% of patients felt more engaged with their health management when using AI tools compared to traditional methods (Palanica et al., 2019). Moreover, AI-powered telemedicine platforms have revolutionized patient engagement by offering remote consultation services. Powell, Henstenburg, Cooper, Hollander, & Rising (2017) explored patient perceptions of AI-enhanced telemedicine in primary care and found that patients appreciated the flexibility and reduced travel time associated with virtual visits. The study noted that patient satisfaction scores were significantly higher for those utilizing telemedicine services, primarily due to the ease of access to healthcare providers and the timely nature of consultations.

AI's role in enhancing patient education is also noteworthy. Hamet and Tremblay (2017) discussed how AI-driven educational platforms deliver personalized health information tailored to individual patient needs. These platforms engage patients by providing them with relevant, easy-to-understand content about their health conditions and treatment options. The study found that patients who used AI educational tools were more informed and proactive in managing their health, leading to higher satisfaction levels (Hamet & Tremblay, 2017). In addition, AI-enabled communication tools such as automated follow-up systems have improved patient adherence to treatment plans. A study by Bickmore, Puskar, Schlenk, Pfeifer, & Sereika (2018) found that patients who received automated reminders and follow-ups through AI systems were more likely to adhere to their medication and appointment schedules. This increased adherence was associated with better health outcomes and higher patient satisfaction, as patients felt supported and consistently engaged in their care process (Bickmore, Puskar, Schlenk, Pfeifer, & Sereika, 2018).

Furthermore, the integration of AI in managing electronic health records (EHRs) has enhanced patient engagement by providing them with easy access to their health information. Wang and Preininger (2019) noted that AI-integrated EHR systems allow patients to view their medical history, track treatment progress, and communicate efficiently with healthcare providers. This transparency and ease of access empower patients, making them active participants in their healthcare journey and significantly improving their satisfaction (Wang & Preininger, 2019).

Overall, the literature strongly supports the positive impact of AI-enabled communication tools on patient satisfaction and engagement. These tools provide immediate, personalized, and continuous support, enhancing the overall patient experience. For secondary healthcare centers in Enugu State, Nigeria, the adoption of such AI technologies could lead to improved patient outcomes and higher satisfaction levels, ultimately contributing to a more efficient and effective healthcare system.

Barriers and Facilitators to AI Adoption in Healthcare Settings in Developing Countries

The adoption of AI-enabled communication tools in healthcare settings in developing countries such as Nigeria is influenced by a complex relationship of cultural, technological, and infrastructural factors. Understanding these barriers and facilitators is crucial for implementing AI technologies effectively in secondary healthcare centers in Enugu State. One of the primary barriers to AI adoption in healthcare settings in developing countries is the inadequacy of technological infrastructure. Many healthcare facilities lack the necessary hardware, software, and reliable internet connectivity required to support AI systems. Arlinghaus, Kus, Behne, & Teuteberg, (2022) highlighted that in many developing regions, healthcare institutions operate with outdated technology, which significantly hampers the deployment of AI tools. Without robust

technological infrastructure, the potential benefits of AI cannot be fully realized, limiting its adoption and integration into everyday healthcare practices.

Financial constraints pose another significant barrier. Implementing AI technologies often requires substantial initial investment and continuous funding for maintenance and updates. According to the World Bank (2019), healthcare institutions in developing countries frequently operate under tight budgetary constraints, making it challenging to allocate sufficient funds for advanced technologies. This financial limitation is exacerbated by the need for ongoing training and support to ensure that healthcare providers can effectively use these technologies. Consequently, the high costs associated with AI implementation can deter healthcare facilities from adopting these tools.

The shortage of a skilled workforce proficient in AI technologies further impedes adoption. McKinsey & Company (2020) emphasized the critical gap in the availability of trained personnel who can develop, implement, and maintain AI systems in healthcare settings in developing countries. These skills gap not only slows the adoption process but also affects the effective utilization of AI tools, as healthcare providers may lack the necessary expertise to operate these systems optimally.

Cultural resistance to new technologies is also a significant barrier. There can be skepticism and mistrust among healthcare providers and patients regarding the reliability and effectiveness of AI tools. Blease et al. (2019) found that cultural attitudes towards technology and change play a crucial role in the acceptance of AI in healthcare. In many cases, there is a fear that AI technologies might replace human jobs or be too complex to use, leading to resistance from both healthcare providers and patients. Overcoming these cultural barriers requires extensive education and demonstration of the tangible benefits of AI in healthcare.

Data privacy and security concerns are particularly pronounced in developing countries, where regulatory frameworks for data protection may be less stringent. UNESCO (2018) noted that the lack of robust data protection policies can deter the adoption of AI in healthcare due to fears of data breaches and misuse of sensitive patient information. Ensuring that AI systems comply with data privacy standards and educating stakeholders about these protections is essential for fostering trust and facilitating adoption.

Despite these barriers, several factors can facilitate the adoption of AI technologies in healthcare settings in developing countries. Government support and conducive policy frameworks are essential. For example, initiatives that promote digital health and provide funding for technological advancements can significantly impact AI adoption. The African Union (2020) highlighted the role of government policies in supporting digital health initiatives, including AI integration in healthcare systems across Africa. Such policies can create an enabling environment for AI adoption by providing necessary resources and regulatory support. International collaboration and funding from global health initiatives can also accelerate AI adoption. Programmes sponsored by organizations such as the World Health Organization (WHO) and the Bill & Melinda Gates Foundation offer technical and financial support to healthcare projects in developing countries. These collaborations often include capacity-building components, which are crucial for sustainable AI integration. WHO (2019) emphasized that international partnerships can provide the expertise and resources needed to overcome financial and technical barriers.

Public-private partnerships are another facilitator of AI adoption. These partnerships can bring together resources, expertise, and technology from the private sector to complement public health initiatives. According to Joudyian, Doshmangir, Mahdavi, Tabrizi, & Gordeev, (2021), successful public-private partnerships in healthcare have led to the deployment of innovative AI solutions in resource-limited settings, thereby improving healthcare delivery. By leveraging the strengths of both sectors, these partnerships can enhance the scalability and sustainability of AI technologies in healthcare (World Economic Forum, 2023; Microsoft, 2021). Investing in capacity building and training for healthcare professionals is also crucial. Educational initiatives that focus on AI and digital health can help bridge the skills gap. Tudo Car et al. (2021) suggested that training programs and workshops that educate healthcare providers

about the benefits and usage of AI tools can enhance acceptance and proficiency, thereby facilitating smoother adoption. Developing a skilled workforce capable of managing and utilizing AI technologies is essential for their effective integration into healthcare settings.

Finally, showcasing successful implementations and the tangible benefits of AI in healthcare can drive wider acceptance. Real-world examples and pilot projects that demonstrate improved healthcare outcomes can help overcome skepticism and build trust among stakeholders. Alowais et al. (2023) indicated that highlighting case studies where AI significantly improved patient care and operational efficiency encouraged other institutions to adopt similar technologies. Demonstrating the practical benefits of AI can motivate healthcare providers to embrace these tools and integrate them into their practice.

Conclusively, while several barriers hinder the adoption of AI technologies in healthcare settings in developing countries, various facilitators can help overcome these challenges. Addressing issues related to technological infrastructure, financial constraints, skilled workforce, cultural resistance, and data privacy is crucial. Simultaneously, leveraging government support, international collaboration, public-private partnerships, capacity building, and success stories can significantly enhance the adoption of AI technologies in healthcare, ultimately improving healthcare delivery and outcomes in settings like Enugu State, Nigeria.

Theoretical Framework

The theoretical framework for this study is grounded in the Technology Acceptance Model (TAM), a widely recognized theory in information systems that seeks to explain how users come to accept and use a technology. Developed by Davis (1989), TAM posits that two main factors influence users' acceptance of a technology: Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). These factors, in turn, affect the users' attitude towards using the technology, which subsequently influences their behavioural attention to use the technology, and ultimately, actual use.

Perceived Usefulness refers to the degree to which a person believes that using a particular system would enhance their job performance. In the context of AI-enabled communication tools in healthcare, PU can be understood as healthcare providers' perceptions of how these tools improve their work efficiency and patient care. Studies have shown that when healthcare professionals perceive technology as useful in their daily tasks, they are more likely to adopt it (Holden & Karsh, 2010). On the other hand, Perceived Ease of Use pertains to the degree to which a person believes that using a particular system would be free of effort. For AI-enabled communication tools, PEOU relates to how easy healthcare providers find these tools to use, without requiring extensive effort or training. The easier the tools are to use, the more likely they are to be adopted by healthcare providers (Venkatesh & Davis, 2000).

TAM also includes the concept of ***Attitude Towards Using (ATU)***, which mediates the relationship between PU, PEOU, and ***Behavioral Intention to Use (BI)***. In this study, ATU reflects the overall positive or negative feelings of healthcare providers towards AI tools, influenced by their perceptions of usefulness and ease of use. Given the complexity of healthcare settings, this study also incorporates elements from the extended TAM models, which include additional factors such as ***Subjective Norm (SN)*** and ***Facilitating Conditions (FC).*** Subjective Norm refers to the social influence that affects an individual's decision to use technology, which can be particularly relevant in a healthcare environment where peer and organizational influences are strong (Taylor & Todd, 1995). Facilitating Conditions involve the availability of resources and support necessary to use the technology, such as training programmes and technical infrastructure (Venkatesh, Morris, Davis, & Davis, 2003).

By applying TAM and its extensions, this study aims to understand the key determinants that influence the adoption and usage of AI-enabled communication tools among healthcare providers in secondary healthcare centers in Enugu State. The model helps in identifying the factors that affect healthcare providers' acceptance of AI tools, their impact on work efficiency, and the overall satisfaction of both providers and patients. The relevance of TAM to this study lies in its ability to provide a structured framework for examining the variables that affect the acceptance and use of AI-enabled communication tools. By focusing

on PU, PEOU, ATU, SN, and FC, this theoretical framework allows for a comprehensive analysis of how these factors interact to influence the adoption of AI technologies in healthcare settings. This, in turn, helps in identifying potential barriers and facilitators to the effective implementation of AI tools, which is crucial for improving healthcare delivery and patient satisfaction in the selected secondary healthcare centers.

Methodology

This study employed a qualitative research design to explore the impact of AI-enabled communication tools on healthcare providers' work efficiency and patient satisfaction in three secondary healthcare centers located in Enugu State, Nigeria. These healthcare centres were selected for their advanced technological infrastructure and high-quality healthcare A qualitative approach was chosen to gain in-depth insights into the experiences and perceptions of both healthcare providers and patients regarding AI technologies. The study utilized semi-structured interviews as the primary method of data collection. This approach allowed flexibility while ensuring key topics related to AI-enabled communication tools, such as perceived usefulness, ease of use, and impact on workflow and patient care, were systematically explored.

The study population included healthcare providers and patients from three secondary healthcare centers in Enugu State: POSH Specialist Hospital, Niger Foundation Hospital, and Annunciation Specialist Hospital. A total of 30 participants were recruited, comprising 15 healthcare providers (doctors and nurses) and 15 patients. Specifically, POSH Specialist Hospital included 4 doctors, 1 nurse, and 5 patients; Niger Foundation Hospital included 4 doctors, 1 nurse, and 5 patients; and Annunciation Specialist Hospital included 3 doctors, 2 nurses, and 5 patients. Purposive sampling technique was employed to select participants who have relevant experiences with AI-enabled communication tools. This method ensured the inclusion of information-rich cases that provided deep insights into the research questions. For healthcare providers, the selection criteria included their roles as doctors or nurses and their direct experience with AI-enabled communication tools, with a minimum of one year of experience at the healthcare facility. This criterion was set to ensure that the selected providers had sufficient exposure to AI technologies and could offer informed perspectives on their impact. Patients were selected based on their interactions with AI-enabled communication tools and were chosen to represent a diverse range of demographics and healthcare needs. This approach ensured a comprehensive understanding of patient experiences with AI tools across different contexts.

The sampling process involved initial identification of potential participants through consultations with the administrative heads of the respective hospitals, who helped identify staff members and patients meeting the selection criteria. Potential participants were then approached individually and provided with detailed information about the study, including its purpose, procedures, and ethical considerations. Informed consent was obtained from all participants, ensuring they understood their rights, including the right to withdraw from the study at any time.

Data collection was conducted using semi-structured interviews with 30 participants, comprising five healthcare providers and five patients from each of the three secondary healthcare centers. An interview guide was developed based on the Technology Acceptance Model (TAM) to explore perceived usefulness (PU), perceived ease of use (PEOU), and other factors influencing the adoption of AI-enabled communication tools. Face-to-face interviews were conducted at the respective healthcare centers to ensure a comfortable and familiar environment. Each interview with a particular healthcare centre lasted between 30 to 45 minutes and was audio-recorded with the participants' consent. The data collected provided rich, detailed insights into the impact of AI-enabled communication tools on healthcare providers' work efficiency and patient satisfaction.

Data Analysis

The data collected from the interviews were transcribed verbatim and analyzed using thematic analysis, a method suitable for identifying, analyzing, and reporting patterns (themes) within qualitative data. The analysis process began with familiarization, during which the transcripts were read multiple times to immerse the researcher in the data and gain a

deep understanding of the content. Significant statements and phrases were then coded to identify recurring concepts and patterns pertinent to the research objectives.

These initial codes were systematically reviewed and grouped into broader themes that encapsulated the core ideas related to the research questions. Themes were then refined to ensure they accurately reflected the data and provided a comprehensive understanding of the experiences and perceptions of healthcare providers and patients regarding AI-enabled communication tools. The themes were clearly defined and organized into a coherent narrative that addressed the central objective of the study: exploring the impact of AI-enabled communication tools on healthcare providers' work efficiency and patient satisfaction in the selected secondary healthcare centers.

NVivo software was employed to facilitate the organization and coding of qualitative data, ensuring a systematic and rigorous analysis process. This software assisted in managing the data, enabling efficient retrieval and examination of coded data segments, and supporting the development of a well-structured thematic framework. The use of NVivo ensured that the analysis was thorough and that the findings were robust, reliable, and aligned with the study's objectives.

Findings

The findings from this study, derived semi-structured interviews with healthcare providers and patients from POSH Specialist Hospital, Niger Foundation Hospital, and Annunciation Specialist Hospital in Enugu State, are presented below. The Thematic analysis of the interview transcripts revealed several key themes related to the impact of AI-enabled communication tools on healthcare provider efficiency and patient satisfaction, aligning with the central objective of understanding these impacts comprehensively.

Theme 1: Improved Work Efficiency

Healthcare providers consistently reported that AI-enabled communication tools significantly enhanced their work efficiency. The automation of administrative tasks, such as appointment scheduling and patient reminders, reduced their workload and allowed them to focus more on patient care.

> "The AI scheduling system has streamlined our appointment process, reducing no-shows and ensuring that we can see more patients in a day." - **Dr. E,** *POSH Specialist Hospital*

Another healthcare provider emphasized how AI tools have minimized time spent on repetitive tasks, thereby improving overall workflow efficiency.

> "With AI handling routine administrative duties, we have more time to dedicate to direct patient care, which improves the quality of our services." - **Nurse F,** *Niger Foundation Hospital*

This theme accentuates the significant role of AI in alleviating administrative burdens and enhancing the efficiency of healthcare providers.

Theme 2: Enhanced Patient Engagement

Patients stressed that AI tools, such as chatbots and virtual assistants, improved their engagement with healthcare services. These tools provided immediate responses to inquiries and offered valuable information, which increased patient satisfaction.

> "Using the AI chatbot to get information about my condition and appointment details was very convenient. It made me feel more involved in my care." - **Patient G**, *Annunciation Specialist Hospital*

Furthermore, some patients noted that AI tools helped them better understand their health conditions and treatment options, fostering a sense of empowerment and involvement in their healthcare journey.

> "The AI assistant explained my medication in a way that was easy to understand, which made me feel more confident about managing my health." - **Patient H,** *POSH Specialist Hospital*

This theme affirms the potential of AI tools to enhance patient engagement and satisfaction by providing accessible and personalized information.

Theme 3: Challenges in AI Adoption

Despite the benefits, both healthcare providers and patients identified several challenges in adopting AI tools. These included technological infrastructure limitations, lack of

training, and concerns about data privacy and security.

> "While AI tools are beneficial, we sometimes face issues with internet connectivity and system downtimes, which can be frustrating." - **Dr. I,** *Niger Foundation Hospital*

Healthcare providers also expressed the need for comprehensive training to effectively utilize AI tools, as inadequate training can hinder the adoption and efficient use of these technologies.

> "There is a learning curve with AI tools. Proper training is crucial to fully leverage their potential and avoid any misuse." - **Nurse J,** *Annunciation Specialist Hospital*

This theme illustrates the importance of addressing infrastructural and educational barriers to maximize the benefits of AI in healthcare settings.

Theme 4: Cultural Attitudes and Trust

Cultural attitudes towards AI and trust in technology were significant factors influencing the adoption of AI tools. Some patients were hesitant to rely on AI for their healthcare needs, preferring direct human interaction.

> "I still prefer talking to a human being rather than a machine, especially when it comes to my health." - **Patient K**, *Niger Foundation Hospital*

Healthcare providers also noted that building trust in AI systems among patients is essential for the successful integration of these tools into routine practice.

> "Educating patients about the benefits and safety of AI tools is important to gain their trust and acceptance." - **Dr. L,** *POSH Specialist Hospital*

This theme highlights the need for efforts to address cultural attitudes and build trust in AI technologies to facilitate their adoption in healthcare.

Theme 5: Impact on Patient-Provider Relationship

The integration of AI tools has had a mixed impact on the patient-provider relationship. While some healthcare providers noted that AI has improved communication efficiency, others expressed concerns about potential depersonalization of care.

> "AI tools help us manage time better, but there is a risk of losing the personal touch that is crucial in healthcare." - **Nurse M,** *Annunciation Specialist Hospital*

Patients also shared similar sentiments, emphasizing the importance of maintaining human interaction alongside AI technologies.

> "AI is helpful, but it cannot replace the empathy and understanding that come from face-to-face interactions with healthcare providers." - **Patient N,** *POSH Specialist Hospital*

This theme confirmed the need for a balanced approach in integrating AI tools, ensuring they complement rather than replace the human aspects of healthcare.

Discussion

This study investigated the experiences and perceptions of healthcare providers and patients regarding the use of AI-enabled communication tools in secondary healthcare centers in Enugu State. The findings demonstrate that these tools significantly enhance work efficiency and patient satisfaction, aligning with the Technology Acceptance Model (TAM), which emphasizes perceived usefulness and ease of use as critical factors for technology adoption (Davis, 1989).

The improvement in healthcare provider efficiency is a notable finding. Providers reported that AI tools streamlined administrative tasks such as appointment scheduling and patient reminders, thereby reducing their workload and allowing them to focus more on direct patient care. This finding corroborates previous research by Jiang et al. (2017) and Bardhan et al. (2020), which highlighted how AI can streamline healthcare processes and improve operational efficiency. Additionally, patients reported positive experiences with AI tools like chatbots and virtual assistants, which provided immediate responses and valuable information, thereby enhancing patient engagement and satisfaction.

However, the study also identified several challenges associated with AI adoption, including technological infrastructure limitations, lack of training, and concerns about data privacy. These issues are consistent with

the barriers highlighted in existing literature, such as the U.S. Government Accountability Office (2020) and Goldfarb and Teodoridis (2018), that discussed similar challenges in the context of AI implementation in healthcare. Addressing these challenges is crucial for the successful integration of AI technologies, particularly in developing countries where infrastructural and resource constraints are more pronounced.

Cultural attitudes and trust in AI technologies emerged as significant factors influencing their adoption. Many patients expressed a preference for direct human interaction over AI-mediated communication, reflecting a broader cultural hesitation towards technology in healthcare. This finding is particularly relevant in the Nigerian context, where traditional and human-centered approaches to healthcare are deeply ingrained. Tailored strategies to build trust and acceptance of AI technologies among patients and healthcare providers are essential for their broader adoption. Educational campaigns and personalized communication strategies could help mitigate these concerns and foster a more positive attitude towards AI.

The practical implications of these findings are far-reaching. Policymakers and healthcare administrators should prioritize enhancing technological infrastructure and providing comprehensive training for healthcare providers to maximize the benefits of AI. Additionally, robust cybersecurity measures must be implemented to address data privacy concerns. Building cultural acceptance and trust in AI through targeted communication strategies and educational initiatives is also crucial.

A notable strength of this study is its in-depth qualitative approach, which provided rich, contextual insights into the experiences of healthcare providers and patients. However, the study's focus on three hospitals in a specific geographic area may limit the generalizability of the findings to other regions or healthcare settings. Future research should explore the long-term impacts of AI adoption on healthcare delivery and patient outcomes in diverse healthcare environments. Comparative studies across different regions and types of healthcare facilities could provide a broader understanding of AI's effectiveness and challenges.

In conclusion, this study contributes to the growing body of knowledge on AI in healthcare, highlighting its potential to enhance provider efficiency and patient satisfaction in secondary healthcare centers in Enugu State. By addressing the identified barriers and leveraging the facilitators, these centers can fully harness AI's potential to improve healthcare delivery. These findings confirm the need for targeted strategies to foster acceptance and effective use of AI technologies, paving the way for more efficient and patient-centered healthcare services.

Conclusion

This study explored the impact of AI-enabled communication tools on healthcare providers' work efficiency and patient satisfaction in three secondary healthcare centers in Enugu State, Nigeria. The findings indicate that AI tools significantly enhance work efficiency by automating routine tasks, thus allowing healthcare providers to focus more on direct patient care. The increased efficiency translates into improved patient satisfaction as patients experience reduced wait times, more personalized care, and better overall service quality. Despite these benefits, barriers such as inadequate technological infrastructure, lack of training, and concerns about data privacy remain significant challenges to the widespread adoption of AI in these settings. Addressing these barriers requires concerted efforts from healthcare administrators, policymakers, and technology providers to ensure the successful integration of AI technologies. This study contributes to the growing body of literature on AI in healthcare and provides valuable insights for enhancing healthcare delivery in developing countries.

Recommendations

Based on the study findings, several recommendations are proposed:

Firstly, healthcare administrators and policymakers should prioritize the enhancement of technological infrastructure and provide comprehensive training for healthcare providers to effectively use AI tools. Implementing robust cybersecurity measures is also crucial to address data privacy concerns and build trust among users. Additionally, targeted strategies, such as educational campaigns and personalized communication

initiatives, should be developed to foster acceptance and trust in AI technologies among patients and healthcare providers.

For future research, studies should explore the long-term impacts of AI adoption on healthcare delivery and patient outcomes across diverse healthcare settings. Further research should also investigate how cultural attitudes towards technology influence AI adoption and identify strategies to overcome resistance. Addressing the limitations of this study, future research should include a broader and more diverse sample to enhance the generalizability of the findings. By pursuing these avenues, researchers can deepen our understanding of AI's role in transforming healthcare and develop more effective strategies for its implementation.

Ethical Considerations

Prior to the interviews', informed consent was sought from all participants, ensuring they were fully aware of the study's purpose, their rights to confidentiality, and their right to withdraw at any time. Written consent was obtained from all participant. All data were anonymized to protect participants' identities, and findings were reported in aggregate form to ensure privacy.

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